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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/511,841	06/27/2005	Jeremy S Lee	14859NP	6271

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EXAMINER	
BHAT, NARAYAN KAMESHWAR	
ART UNIT	**PAPER NUMBER**
1634	
MAIL DATE	**DELIVERY MODE**
11/02/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/511,841	LEE ET AL.	
	Examiner	Art Unit	
	Narayan K. Bhat	1634	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 September 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) *14* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☒ Claim(s) *13* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 October 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *6/27/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Claims 1-14 are pending in this application.

2. Applicant's election with traverse of Group I, claims 1-13, in the reply filed on September 20, 2007 is acknowledged. The traversal is on the grounds that both group I and II are closely related and there is no serious burden on the examiner to examine all of the claims in the present application. The claims of the instant 371 national stage application were found to lack unity of invention (where unity of invention requires a special technical feature) due to the lack of a special technical feature between the different groups. Thus the burden of the search of these different inventions is moot.

3. Claim 14 is withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on September 20, 2007.

4. Claims 1-13 are under prosecution.

Claim Objections

5. Claim 13 is objected to because of the following informalities: It appears that there is typo error in line 9, in the phrase "lineal translocation". Appropriate correction is required.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 1-3 and 5-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aich et al (WO 99/31115, herein after Aich) in view of Akeson et al (USPN 6,936,433 filed Nov. 21, 2005).

Regarding claim 1, Aich teaches a process of using conductive metal containing nucleic acids that includes the incorporation of a metal ion in to a nucleic acid duplex as the duplex forms in the hybridization medium (Fig. 1, pg. 8, lines 9-18) and further teaches the first and the second nucleic acid strands comprise a plurality of nitrogen-containing aromatic bases covalently linked by a backbone, the nitrogen-containing

aromatic bases of the first nucleic acid strand being capable of being joined by hydrogen bonding in the hybridization medium to the nitrogen-containing aromatic bases of the second nucleic acid strand so that the nitrogen-containing aromatic bases on the first and the second nucleic acid strands form hydrogen-bonded base pairs in stacked arrangement in the nucleic acid duplex, the hydrogen-bonded base pairs being capable of interchelating the metal cation coordinated to a nitrogen atom in one of the aromatic nitrogen-containing aromatic bases to form the metal-containing nucleic acid duplex (pg. 3, lines 14-26).

Regarding claim 2, Aich teaches that the step of reading information from the nucleic acid polymer by detecting the presence or absence of the metal cation in the nucleic acid duplex (pg. 4, lines 11-14).

Regarding claim 3, Aich teaches the presence or absence of metal cation is detected by measuring electrical conductance (pg. 12, lines 1-10).

Regarding claim 7, Aich teaches the hybridization medium for introducing metal in to the nucleic acid that contains metal ion in a high pH aqueous solution, which is electrically conductive (pg. 8, lines 9-18) and the dissociation medium to convert M-DNA back to B-DNA that contains metal ions in a low pH aqueous solution (pg. 10, lines 18-19), which is an electrically conductive. Since there is no limiting definition of the hybridization medium and the dissociation medium, the aqueous solution taught by

Aich, which incorporates the metal and dislodge the metal from M-DNA meets the limitations of the claim.

Regarding claim 8, Aich teaches that the first and the second nucleic acid strands are deoxyribonucleic acids and the nitrogen-containing aromatic bases are selected from the group consisting of adenine, thymine, guanine and cytosine (pg. 4, lines 7-9).

Regarding claim 9, Aich teaches that the metal cation is selected from the group consisting of Zn2+, Co2+, and Ni2+ (pg. 4, lines 11-14).

Regarding claim 10, Aich teaches that the metal cations are substituted for imine protons of the nitrogen-containing aromatic bases, and the nitrogen-containing aromatic bases are selected from the group consisting of thymine and guanosine (pg. 4, lines 16-19).

Regarding claim 11, Aich teaches that at least one of the aromatic nitrogen-containing aromatic bases is thymine, having an N3 nitrogen atom, and the metal cation is coordinated by the N3 nitrogen atom (pg. 4, lines 16-19).

Regarding claim 12, Aich teaches that at least one of the aromatic nitrogen-containing aromatic bases is guanine, having an N1 nitrogen atom, and the metal cation is coordinated by the N1 nitrogen atom (pg. 4, lines 16-19).

Aich does not teach the channel and the translocation of first and second nucleic acid strands through a channel. However, channel and the translocation of nucleic acids through the channel was known in the art at the time of claimed invention was made as taught by Akeson, who teaches a process of recording information in a DNA duplex that include modulation of translocation of duplex and single stranded DNA in a nanopore, that is a channel, containing high salt medium conducive for hairpin formation, i.e., double strand DNA duplex formation (column 25, lines 47-54). Akeson also teaches applying electric filed to move the double stranded hairpin duplex across the nanopore and further teaches the hairpin stem rattles and dissociates the stem in to extended single stranded molecule to traverse through the channel (column 25, lines 47-67). Teachings of Aich providing metal containing DNA in a hybridization medium and teachings of Akeson of dissociating the DNA duplex in to single strand DNA to traverse through the pore provides all the steps recited in claim 1.

Regarding claim 5, Akelson teaches that the channel is formed in a lipid membrane (column 24, lines 61-62).

Regarding claim 6, Akelson teaches that the channel is a pore forming protein (column 24, lines 46-48).

Akeson also teaches that translocation of nucleic acid duplex across the pore provides a sufficiently large signal for accurately assigning a unique identifying signature to the nucleic acid duplex (columns 6 and 8, lines 21-33 and 42-58).

It would have been prima facia obvious to one having the ordinary skill in the art at the time the invention was made to substitute the nanopore based method of Akelson to metal containing nucleic acids of Aich with a reasonable expectation of success.

An artisan would have been motivated to substitute the nanopore based method of Akelson to metal containing nucleic acids of Aich with the expected benefit of translocating the nucleic acid duplex across the pore providing a sufficiently large signal for accurately assigning an unique identifying signature to the nucleic acid duplex as taught by Akelson (columns 6 and 8, lines 21-33 and 42-58) thereby recording the information for the conductive metal containing nucleic acids of Aich thus enhancing the utilities of conductive metal containing nucleic acids of Aich.

9. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Aich et al (WO 99/31115, herein after Aich) in view of Akeson et al (USPN 6,936,433 filed Nov. 21, 2005) and further in view of Li et al (PNAS, 1991, 88, 26-30).

Regarding claim 13, Aich teaches a process for detecting a base pair mismatch in a nucleic acid polymer that includes detecting the presence or absence of divalent metal cations in base pairs of a nucleic acid duplex by measuring electrical conductance

(pg. 12, lines 1-10) and further teaches a process of incorporating a metal ion in to a nucleic acid duplex as the duplex forms in the hybridization medium (Fig. 1, pg. 8, lines 9-18). Aich also teaches the first and the second nucleic acid strands comprise a plurality of nitrogen-containing aromatic bases covalently linked by a backbone, the nitrogen-containing aromatic bases of the first nucleic acid strand being capable of being joined by hydrogen bonding in the hybridization medium to the nitrogen-containing aromatic bases of the second nucleic acid strand so that the nitrogen-containing aromatic bases on the first and the second nucleic acid strands form hydrogen-bonded base pairs in stacked arrangement in the nucleic acid duplex, the hydrogen-bonded base pairs being capable of interchelating the metal cation coordinated to a nitrogen atom in one of the aromatic nitrogen-containing aromatic bases to form the metal-containing nucleic acid duplex (pg. 3, lines 14-26).

Alch also teaches the matching hydrogen-bonded base pairs of the metal-containing nucleic acid duplex comprise an interchelated divalent metal cation coordinated to a nitrogen atom in one of the aromatic nitrogen-containing aromatic bases (Fig. 2). Aich teaches that for intercalation of divalent cation hydrogen bond formation is necessary between complementary base pairs. In case of mismatched base pair such hydrogen bond formation is dramatically reduced resulting in duplex instability (as evidenced by Li et al PNAS, 1991, 88, 26-30, see abstract) thus teaching a mismatched base pair does not interchelate a divalent metal cation.

Aich does not teach the channel and the translocation of first and second nucleic acid strands through a channel. However, channel and the translocation of nucleic acids

through the channel was known in the art at the time of claimed invention was made as taught by Akeson, who teaches a process of recording information in a DNA duplex that include modulation of translocation of single stranded DNA monomer by monomer (columns 24 and 25, lines 61-67 and 1-3). Akeson also teaches applying electric filed to move the monomer by monomer across the nanopore (column 25, lines 1-3 and 47-67). Teachings of Aich providing the detection of presence or absence of divalent metal cations in a base pairs of a nucleic acid duplex and teachings of Akeson of translocation of monomer by monomer through the pore provides all the steps recited in claim 13. Akeson also teaches that translocation of nucleic acid duplex across the pore provides a sufficiently large signal for accurately assigning a unique identifying signature to the nucleic acid duplex (columns 6 and 8, lines 21-33 and 42-58).

It would have been prima facia obvious to one having the ordinary skill in the art at the time the invention was made to substitute the nanopore based method of Akelson to metal containing nucleic acids of Aich with a reasonable expectation of success.

An artisan would have been motivated to substitute the nanopore based method of Akelson to metal containing nucleic acids of Aich with the expected benefit of translocating the nucleic acid duplex across the pore providing a sufficiently large signal for accurately assigning an unique identifying signature to the nucleic acid duplex as taught by Akelson (columns 6 and 8, lines 21-33 and 42-58) thereby recording the information for the conductive metal containing nucleic acids of Aich thus enhancing the utilities of conductive metal containing nucleic acids of Aich.

10. Claims 1 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aich et al (WO 99/31115, herein after Aich) in view of Akeson et al (USPN 6,936,433 filed Nov. 21, 2005) as applied to claims 1 and its dependent claims above further in view of Anazawa et al (USPN 6,136, 543 issued Oct. 24, 2000).

Claim 4 is dependent on claim 1. Teachings of Aich in view of Akelson regarding claim 1 are described previously in this office action in section 10.

Regarding claim 4, Aich in view of Akelson teaches translocation of the nucleic acid duplex through the nanopore by applying electric field (Akelson, column 1, lines 43-63) but does not teach nucleic acid duplex attached to magnetic bead. However attachment of nucleic acids to magnetic bead and movement across the pore using magnetic field was known in the art at the time of claimed invention was made as taught by Anazawa who teaches coupling of nucleic acids to a magnetic bead by coupling the target DNA first to a nonmagnetic bead containing single stranded DNA and stretching the DNA duplex on the non magnetic bead to the magnetic bead using magnetic force (Fig. 9, magnetic bead # 6, nonmagnetic bead # 5, DNA # 7, column 8, lines 1-28), thus providing nucleic acid duplex coupled to a magnetic bead and translocation of DNA using magnetic filed across the cell, i.e., channel (column 8, lines 3-23).

Thus, as described above, all of the component steps, i.e., coupling of nucleic acid duplex to magnetic bead, modulating the translocation of the DNA duplex either through the cell or through the nanopore recited in the instantly claimed invention were known in references of Aich in view of Akeson and Anazawa et al. The only difference is the combination of known method steps of the prior art into a single method to include

all the steps, which would be equivalent to a translocation of the nucleic acid duplex through the channel mediated by magnetic field across the channel.

Thus it would have been obvious to one having ordinary skill in the art to apply the coupling of nucleic acids to magnetic bead and magnetic force taught by Anazawa et al to the translocation of the duplex DNA through the nanopore by the method of Aich in view of Akeson with the expected benefit of achieving a translocation of DNA using magnetic force.

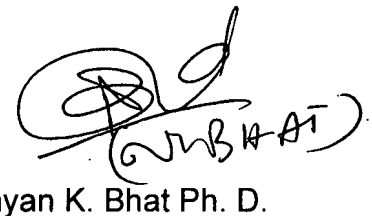
Conclusion

11. No claim is allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Narayan K. Bhat whose telephone number is (571)-272-5540. The examiner can normally be reached on 8.30 am to 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ram R. Shukla can be reached on (571)-272-0735. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Narayan K. Bhat Ph. D.

Examiner

Art Unit 1634

RAM R. SHUKLA, PH.D.
SUPERVISORY PATENT EXAMINER